DAMIC-1K

Collaborators: approx. 30 members, 12 institutions

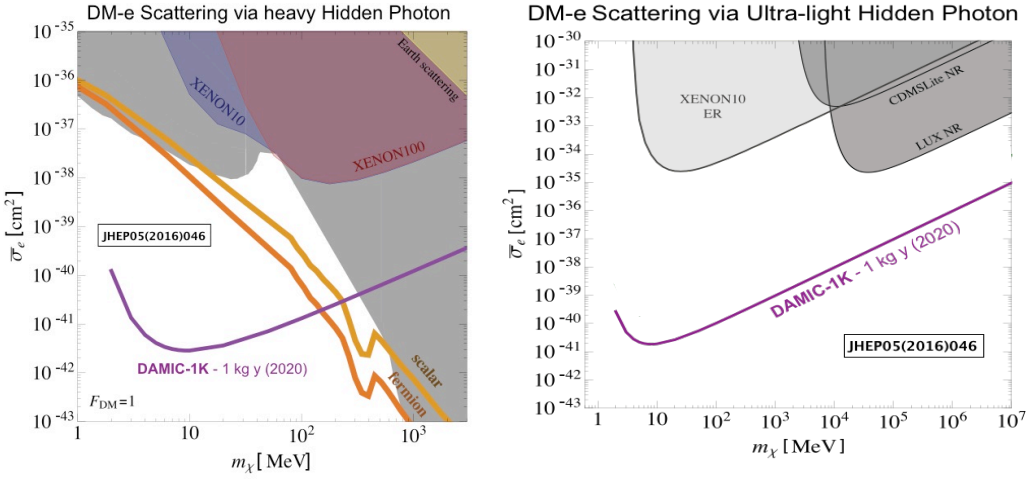
Location: SNOLAB, Canada - other sites: SURF (US); Modane (France); Gran Sasso (Italy)

Primary physics goals: The search for low-mass dark matter (DM) in a broad range from ≈ 1 eV to few GeV. In particular, DAMIC-1K will take a leap forward of several orders of magnitude in the exploration of the "dark sector" where interactions are mediated by dark or hidden photons.

Summary of the experimental approach and setup: DAMIC-1K is a low-background (≈ 0.1 dru), low-threshold (≤2 e^-) experiment with a total detector mass of ≈ one kg. It employs high-resistivity, thick CCDs to detect sub-keV energy deposits in the silicon bulk. The technology to fabricate DAMIC-1K CCDs is already proven, and entails a modest increase in area and thickness with respect to the existing DAMIC detectors successfully in operation at SNOLAB. The CCDs will feature a Skipper design – already demonstrated in a small size CCD and to be extensively tested in SENSEI – and digital filtering to achieve sub-electron noise and fast readout. Time-correlated spatial coincidences will be used to reject the background from cosmogenic ^{32}Si - a unique DAMIC capability that allows to reach the neutrino floor in a future generation experiment.

Summary of existing and future physics results: We have measured radioactive contamination in the silicon bulk (e.g. ^{32}Si) [1], performed the best measurement of the quenching factor in silicon down to 60 eV_{ee} [2], placed limits on low-mass WIMPS [3], and placed the first direct experimental limit on hidden photon DM [4]. The DAMIC100 detector in operation at SNOLAB will perform precise measurements of backgrounds (^{32}Si and tritium) and place dark matter limits with O(10 kg day) exposure.

Plots that summarize the experimental sensitivity:



Timescale:

Year 1-2: R&D for sub-electron noise (strong synergy with SENSEI) and background measurements; results from DAMIC100; finalize DAMIC-1K design
Year 3-4: components validation (test at SNOLAB); construction

Budget: ≈ 3 M$

References:

[1] A. Aguilar-Arevalo et al., Measurement of radioactive contamination in the high-resistivity silicon CCDs of the DAMIC experiment, *JINST 10 (2015) P08014*

[2] A. Chavarria et al., Measurement of the ionization produced by sub-keV silicon nuclear recoils in a CCD dark matter detector**,** *Phys. Rev. D 94, 082007 (2016)*;

F. Izraelevitch et al., Antonella: A nuclear-recoil ionization-efficiency measurement in silicon at low energies, *JINST 12 (2017) P06014*

[3] A. Aguilar-Arevalo et al., Search for low-mass WIMPs in a 0.6 kg day exposure of the DAMIC experiment at SNOLAB, *Phys. Rev. D 94, 082006 (2016)*

[4] A. Aguilar-Arevalo et al., First direct detection constraints on eV-scale hidden-photon dark matter with DAMIC at SNOLAB, *Phys. Rev. Lett. 118, 141803 (2017)*